

## Nutritional Status Assessment (SMO 016E)

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The Nutritional Status Assessment Supplemental Medical Objective was initiated to expand nominal clinical nutrition testing of ISS astronauts, and to gain a better understanding of the time course of changes in nutritional status during flight. The primary activity of this effort was collecting blood and urine samples during flight for analysis after return to Earth. Samples were subjected to a battery of tests. The resulting data provide a comprehensive survey of how nutritional status and related systems are affected by 4-6 months of space flight. Analysis of these data has yielded many findings to date, including:

- **Vision.** Documented evidence that biochemical markers involved in one-carbon metabolism were altered in crewmembers who experienced vision-related issues during and after flight (1).
- **Iron, Oxidative Stress, and Bone.** In-flight data document a clear association of increased iron stores, markers of oxidative damage to DNA, and bone loss (2).
- **Exercise.** Documented that well-nourished crewmembers performing heavy resistance exercise returned from ISS with bone mineral densities unchanged from preflight (3). Furthermore, the response of bone to space flight and exercise countermeasures was the same in men and women (4).
- **Body Mass.** Crewmembers lose 2-5% of their body mass in the first month of flight, and maintain the lower body mass during flight (5). Additionally, the two devices to measure body mass on orbit, the SLAMMD and BMMD, provide similar results (5).
- **Cytokines.** Findings indicated that a pattern of persistent physiological adaptations occurs during space flight that includes shifts in immune and hormonal regulation (6).
- **Fish/Bone.** Documented a relationship between fish intake and bone loss in astronauts (that is, those who ate more fish lost less bone) (7).
- **Vitamin K.** Documented that in generally well-fed and otherwise healthy individuals, vitamin K status and bone vitamin K-dependent proteins are unaffected by space flight (and bed rest) (8).
- **Testosterone.** Documented that blood concentrations of testosterone were unchanged during flight, but a transient decline occurred after landing (9).
- **Calcium.** Nutrition SMO data contributed to the ISS Program by helping understand how and why the Urine Processor Assembly clogged with calcium sulfate precipitate (10).
- **Sample Processing.** Ground-based analytical testing results have also been published (11).

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